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PILOT AGING POLICIES IN INTERNATIONAL AIRLINES

I. GLAZER, M.D Chief Medical Officer EL-AL ISRAEL AIRLINES, LTD. BEN GURION AIRPORT, ISRAEL.

INTRODUCTION: For decades regulatory agencies adhered to an arbitrary upper age limit for pilots engaged in passenger operations. Based on these rules and other considerations airlines set up contractual agreements with unions and/or individual pilots. With the advent of modern diagnostic techniques and operational monitoring these rules and contracts were recently challenged.

DEVELOPMENT: Stress should be put on medical-physiological criteria rather than purely chronological arbitrary limits. Performance capability is essential in determining one's fitness as a pilot. Medical technology provides new diagnostic techniques which enable us to predict with better confidence that a pilot will not become suddenly incapacitated especially where the cardiovascular system is concerned. The degradation of a pilot's perceptual, psychomotor and intellectual functioning which is expected in the aging process may be detected and assessed with a great measure of confidence by physicians, co-workers and family and documented during simulator performance and line checking. In a relatively small airline like EL-AL the medical officers and flight operation supervisory staff know each pilot personally and in many cases are familiar with the family environment. This enables them to detect occasionally some hidden stresses. EL-AL maintains the long-established mandatory retirement of operating crew members at age of sixty. However it was recently agreed (as first officers only) on a yearly contract provided they fulfil the medical and operational criteria. This meets the current government regulations and we feel confident that no undue risk is involved. Similar arrangements exist in a few other airlines. Our first year's experience will be discussed.

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REVIEW OF PERFORMANCE, MEDICAL, AND OPERATIONAL DATA ON PILOT AGING ISSUES. J.H. Stoklosa, Ph.D. Life Sciences Division, National Aeronautics and Space Administration, Washington, D.C. 20546

Introduction: An extensive review of the literature and studies relating to performance, medical, operational, and legal data regarding pilot aging issues was performed in order to determine what evidence there is, if any, to support mandatory pilot retirement. Popular misconceptions about aging, including the failure to distinguish between the normal aging process and disease prosesses that occur more frequently in older individuals, continue to contribute to much of the misunderstanding and controversy that surround this issue. Results: Review of medical data related to the pilot aging issue indicate that recent improvements in medical diagnostic and treatment technology have made it possible to identify to a high degree individuals who are at risk for developing sudden incapicitating illness and for treating those with disqualifying medical conditions. Performance studies revealed that after controlling for the presence of disease states, older pilots are able to perform as well as younger pilots on many performance tasks. Review of accident data showed that older, healthy pilots do not have higher accident rates than younger pilots and, indeed, evidence suggests that older pilots have an advantage in the cockpit due to higher experience levels. The Man-Machine-Mission-Environment interface of factors can be managed through structured, supervised, and enhanced operations, maintenance, flight reviews, and safety procedures in order to endure safe and productive operations by reducing the margin of error and by increasing the margin of safety. Conclusion: There is no evidence indicating any specific age as an arbitrary cut-off point for pilots to perform their flight duties. A combination of regular medical screening, performance evaluation, enhanced operational maintenance, and safety procedures can more effectively ensure a safe pilot population than can a mandatory retirement policy based on arbitrary age restrictions.

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FLIGHT CREW FATIGUE IN ADVANCED LONG-HAUL COMMERCIAL AIRPLANES - R.C. Graeber*. Boeing Commercial Airplane Group, Seattle, WA.

The rapid increase in two-crew glass cockpit airplanes operating on long-haul routes has generated international interest in better understanding how fatigue affects crew performance on advanced commerical flight decks. This topic provides a unique opportunity for human factors experts to focus on a combination of biomedical, operational, and equipment design issues that directly impact human operators. The panel will examine the issue from the different perspectives of individuals who are actively involved in the ongoing debate. The presentations will emphasize the physiological basis for long-haul crew fatigue, the contribution of the flight deck environment to crew alertness, and the operational factors unique to such airplanes in the long-range environment. Panelists will also discuss both regulatory, operational and design approaches for mitigating the potentially negative effects on overall crew performance. A general discussion will follow completion of the individual papers.

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ALERTNESS MANAGEMENT IN TWO-PERSON LONG-HAUL FLIGHT OPERATIONS. M. R. Rosekind and P. H. Gander*. NASA Ames Research Center, Moffett Field, CA and San Jose State University Foundation at NASA Ames Research Center.

Long-haul flight operations involve cumulative sleep loss, circadian disruption, and extended and irregular duty schedules. These factors reduce pilot alertness and performance on the flightdeck. Conceptually and operationally, alertness management in flight operations can be divided into preventive strategies and operational countermeasures. Preventive strategies are utilized prior to a duty period to mitigate or reduce the effects of sleep loss, circadian disruption and fatigue during subsequent flight operations. Operational countermeasures are used during operations as acute techniques for maintaining performance and alertness. Results from previous NASA Ames field studies document the sleep loss and circadian disruption in three-person long-haul flying and illustrate the application of preventive strategies and operational countermeasures. One strategy that can be used in both a preventive and operational manner is strategic napping. The application and effectiveness of strategic napping in long-haul operations will be discussed. Finally, long-haul flying in two-person highly automated aircraft capable of extended range operations will create new challenges to maintaining pilot alertness and performance. Alertness management issues in this flight environment will be explored.

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A PILOT'S PERSPECTIVE ON LONG HAUL OPERATIONS IN TWO CREW COCKPITS. - Paul D. Gallaher, Northwest Airlines, Minneapolis, MN.

A comphehensive approach to the issue of flight crew fatigue must address crew performance requirements as well as psychophysiological factors such as sleep loss and circadian rhythmicity. Emphasis on the former has increased with the relatively recent introduction of advanced two-crew airplanes and the acompanying growth in flight deck automation and CRT displays. This paper will address these factors from a pilot's perspective. Included will be a description of typical flight profiles and crew duties along with the associated occurrence of boredom and fatigue. One topic of particular concern is the programming of automated flight systems in terminal areas at the end of long-haul flight segments. The discussion will also focus on the use of augmented crew during extended range operations and the problems encountered in the scheduling of rest breaks in onboard sleep facilities.

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TWO-MAN CREW OPERATIONS: PILOT'S VIEWPOINT. D. E. Hudson*. Airline Pilots Association- Aeromedical, Denver, Colorado.

Commercial air operators are moving toward greater use of advanced-technology aircraft with increasing levels of automation. Frequently, this transition entails a reduction in the size of cockpit crew; specifically, from 3 to 2 pilots, eliminating the position of flight engineer. This reduction is being accomplished in the context of a dramatic increase in commercial traffic, no revision in FAA Flight Time/Duty Time regulations and efforts by commercial carriers to exploit the full potential of the new, long range aircraft coming into service. Professional pilot groups are very concerned that human factors considerations, i.e., fatigue, circadian dysrhythmia, scheduling parameters and the human/automa-tion interface are not being adequately addressed.

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THE REGULATION OF TWO-CREW EXTENDED RANGE OPERATIONS: A EUROPEAN VIEW. **H. M. Wegmann*. DLR-Institute for Aerospace Medicine, Cologne, Germany.**

Extending two-crew operations to international long-haul routes has raised critical concerns about flight safety. As a consequence, special limitations have been introduced by some regulatory authorities reducing maximum flight and duty time for two-crew on these routes as compared with crew configurations of three and more members. This issue has also been addressed in the process of formulating new flight time limitations for theEuropean Community which become necessary when the Internal Market will be established in 1993. It is the purpose of this presentation to summarize the different views that have been presented and developed during a number of committee meetings. On-board resting and crew augmentation are further topics that will be addressed in this context. Conclusions and recommendations resulting from inflight studies as well as from many discussions will be presented.

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THE OPERATIONAL MANAGEMENT OF LONG-RANGE PILOT VIGILANCE. **- JJ. Speyer, J. P. Fouillot, A. Coblentz and R. D. Blomberg. Airbus Industrie, Toulouse, France; Laboratory of Applied Athropology, University Rene Descartes, Paris, France; and Dunlap Associates, Norwalk, CN.**

The development of techniques to improve the operational management of long-range pilot vigilance is part of the current work in support of the upcoming introduction of the A340 airplane. This work is being performed with several cooperating airlines on scheduled routes on a variety of long-haul aircraft. The two major directions include the development of practical advice for (1) organizing onboard rest during augmented crew operations and (2) for enhancing operational awareness through meaningful interactions with electronic interfaces. The first of these efforts will be discussed with regard to recommendations for enroute layover rest taking into account the crew's biological clocks and for inflight sleep/relaxation in dedicated onboard quarters, including the issue of crew rotation and the associated handover of aircraft control and responsibility. For the second major effort the following potential interactions will be reviewed as potential ways for improving vigilance: systems management (e.g., periodic ECAM checks), fuel management (e.g., periodic FMS entries/monitoring), navigation management (e.g., periodic position checks and NAVAID comparisons), and communications management (e.g., periodic ATIS with ACARS).

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REPORTED IN-FLIGHT AND GROUND INCIDENTS INVOLVING HAZARDOUS MILITARY CARGO. V.M. Voge* Armstrong Laboratories, Clinical Sciences Division, Brooks Air Force Base, TX 78235.

The three military services have very strict guidelines regarding the transportation of hazardous cargo in military aircraft. Aviation personnel, including flight surgeons, many times feel these guidelines are adequate and scrupulously adhered to. Information from the three services' safety centers will be presented to dispute this perception. This information will include the most common types of non-adherence to regulations and the types of hazardous cargos most frequently found to be a problem. The purpose of the presentation is to sensitize military aeromedical personnel to the possible hazards they might encounter in the field. In this manner, possible aeromedical contingency plans might be formulated to avert possible future hazardous cargo problems. Other panel members will address such plans.

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HAZARDOUS MATERIALS CARGO CAUSING IN-FLIGHT INCIDENTS--RECENT U.S. EXPERIENCE. D.K. Broadwell, MD.* Duke University, Division of Occupational and Environmental Medicine, Durham, NC 27514.

INTRODUCTION. The transportation of hazardous materials by air can have serious consequences, such as the 1988 in-flight fire aboard a passenger DC-9 in Nashville. This study is an exploratory effort to characterize how often hazardous materials cause in-flight problems, and the frequency of "hidden" or undeclared hazards. METHODS. All available air transport Hazardous Material Incident Reports for the years 1989 and 1990 were analyzed. These reports were examined through the FAA's Dangerous Goods/Explosive Security Branch, and through the Dept. of Transportation's Hazardous Materials Information System. RESULTS. 482 consecutive incidents were analyzed. 13 reports indicated that the crew was forced to take in-flight actions, such as emergency diversions, deployment and use of oxygen masks, and expedited landings. 7 of 92 total injuries for the reporting period were attributable to these incidents. Another 17 incidents were "near misses", with ground crew identifying fires, smoke, or other hazards in the immediate pre- or post-flight period. Fifty per cent of these two categories were caused by "hidden shipments." CONCLUSIONS. Despite efforts by carriers, incidents with in-flight implications continue, usually caused by the public themselves. More "toxic" education is indicated for air travelers, shippers, and physicians involved in air transportation mishaps.

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INCIDENT COMMAND SYSTEM: HOW IT WORKS AND WHERE YOU FIT IN. Dennis Wheeler, Division Chief for Firefighting, Miami Fire Department, Miami, FL.

The Incident Command System (ICS) was developed several years ago to bring order to the overlapping functions existing in any emergency. This is accomplished by better organizing the scene of an emergency through a chain of command system. Nationwide, civilian communities have adopted the ICS as a blueprint to enhance their mass casualty plans. The ICS is an organized plan which establishes the duties, responsibilities and equipment for the: incident commander, EMS representative, EMS sector boss, triage officer, triage team, initial care/transport team, transportation officer, medical care officer, medical care team member, EMS communications officer, and EMS supply officer. It also establishes proper lines of communication and authority to avoid confusion and turf disputes. The system, along with its benefits and problems, will be addressed by the speaker.

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HAZARDOUS MATERIALS ACCIDENTS: INITIAL SCENE EVALUATION AND PATIENT TREATMENT R.B. Leonard Ph.D., M.D., Dept. of Emergency Medicine, Bowman Gray School of Medicine, Winston-Salem, NC 27157-1089

Hazardous materials is the collective term used to describe those chemical commodities which are toxic, flammable, explosive or corrosive. They may be solid, liquid or gaseous and be shipped by air, barge, train, truck or pipeline. Shipments can range from a variety of different materials in small containers up to railcars or tank trucks carrying 10,000 gallons. Emergency personnel arriving first at the scene of a hazardous materials accident are met with a variety of unique problems which require quick decisions: (1) The identification of the hazardous material(s) involved (2) evaluation of the risk to victims and emergency personnel (3) evaluation of risk to the surrounding community (4) how to safely rescue victims and (5) determining the proper medical care for victims. The ability to make such decisions requires extensive knowledge and planning and is complicated by the fact that frequently the identification of the hazardous materials is initially unknown. In addition, they may be burning and/or reacting with each other and 80% of such commodities have no medical toxicity data known. Nonetheless, medical personnel can render valuable treatment by evaluating the patients and knowing the types of pathology caused by hazardous materials: (1) ocular injury (2) airway and/or pulmonary damage (3) chemical skin burns and (4) systemic toxicity.

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HAZARDOUS MATERIALS TRANSPORT AND THE FAA. Author to be announced. FAA Southeastern Region, Atlanta, GA

The FAA has an office dedicated to hazardous materials coordiation, from a regulatory standpoint. This office conducts investigations as to why a hazardous spill occurred and takes appropriate enforcement action to prevent a recurrence. The speaker will explain the governing regulation (49-CFR) and his agency's responsibilities. He will also give examples of various problems that have been encountered, and their resolution.

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THE CRASH SITE: SAFETY GUIDELINES FOR RESPONDERS
D. Elcombe MD*, Transportation Safety Board of Canada, PO Box 9120, Ottawa, Ontario Canada K1G 3T8

The typical crash site, whether large or small, agricultural or military, presents a wide variety of potential safety concerns. The usual first responders, firemen, are well-trained in procedures to ensure their personal safety, but in the author's experience, flight surgeons and accident investigators are much less well-prepared to deal with potential accident site hazards. This paper presents an overview of the types of hazards found at accident sites and provides a review of two surveys conducted to determine what problems had been encountered and whether or not these resulted in acute or delayed morbidity. The Canadian climate also frequently poses severe obstacles to safe work and therefore solutions to weather related hardships will be reviewed. In summary, guidelines for crash site assessment, clothing, protective equipment and safe behaviour are presented.

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ENVIRONMENTAL PATHOLOGY: THE AFIP EXPERIENCE WITH HAZARDOUS MATERIAL INVESTIGATIONS. Glenn N. Wagner, D.O.* Armed Forces Institute of Pathology, Washington, D.C. 20306-6000.

The Armed Forces Institute of Pathology (AFIP) has responded to a number of disasters in which potential biohazards were of concern. On-site response teams are composed of selected personnel based on their training and expertise, most are pathologists, many are members of the Armed Forces Medical Examiner's Office tasked with investigating medicolegal deaths coming under DoD jurisdiction or so directed by appropriate authority. These disasters include multiple aircraft mishaps including the Challenger disaster and Gander, Newfoundland crash, the Iowa turret explosion and the fatalities of Deserts Shield and Storm. This discussion deals with the planning, required facilities and variability of disasters and the AFIP's experience in collecting, diagnosing, and analyzing the tissues of affected individuals including people and animals where hazardous materials have been present and a factor in the investigation. These analyses are comparative, comprehensive, and multidisciplinary. Through histopathological and high-technology instrumental toxicological and molecular analyses, a variety of biological, chemical and radiation threats are evaluated. This experience underscores the need to develop and have a disaster plan and the resources and operative interactions necessary to bring the investigations to a successful conclusion.

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MULTICULTURAL AND GLOBAL DIMENSIONS OF CARING. M. A. Ray*, Florida Atlantic University, Boca Raton, FL; USAF/SAM, Brooks AFB, Texas.

INTRODUCTION. Multicultural factors increasingly are becoming more important as the United States is continuing its leadership role in the global community. During Operation Desert Storm, military personnel were interacting with others from multicultural perspectives. Health care personnel engaged in caring for people from diverse culture groups, some which they had never had exposure to before this period in their lives. Television exposed civilians to this diversity as well. The experiences opened up a new world in the new world order for all Americans.

METHODS. Content of this paper is gleaned from theoretical and experiential knowledge of comparing and contrasting concepts related to a variety of cultures, and from philosophical, ethical and nursing dimensions of caring. Methodologically, comparing and contrasting multicultural dimensions and caring interaction facilitate understanding and is the vehicle by which cultural patterns are known and appreciated.

RESULTS. By comparing and contrasting the complexities inherent in the concepts of cultural and ethnic diversity and similarity, cultural survival, cultural relevancy, culture value conflict and its multiple coordinates e.g. prejudice, intergenerational conflict, economics, etc., new images of caring to build a global civic culture can be recognized.

CONCLUSIONS. Multicultural caring education is imperative to understanding and advancing the global culture in the modern world.

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OPERATION PROVIDE COMFORT: A NURSING PERSPECTIVE. L.J. CASHION, J.S. BECK. 48TFW HOSPITAL, RAF LAKENHEATH, U.K. APO AE 09464.

INTRODUCTION. On 26 April 1991, 52 members of the 48TH TFW Air Transportable Hospital were tasked to support Operation Provide Comfort. Augmented with medical staff from several USAFE bases, the ATH deployed to a humanitarian service support base in Silopi, Turkey. This paper outlines nursing care given to allied military forces and Kurdish refugees in mountain and safe haven camps. METHODS. Types of patients seen in the ATH inpatient setting included: 1) Violent injuries requiring urgent surgical intervention and aeromedical evacuation. 2) Injuries requiring minor surgical intervention and hospitalization, and 3) Non-surgical illnesses including acute diarrheal syndrome, dehydration, heat exhaustion, and malaria requiring palliative treatment. In the refugee relief area, ATH members provided health screening and medical treatment to displaced Kurdish refugees. RESULTS. Over 3300 outpatient visits accomplished in which military were treated and could return to duty. 325 inpatient admissions requiring medical-surgical interventions, 97 of which required air-evacuation to definitive care facilities. 13,000 refugee contacts were made by ATH personnel among 6 camp locations. CONCLUSION. This presentation will disseminate information regarding nursing care in an austere environment and recommendations for future deployments.

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A STUDY TO OPTIMIZE THE COUNTERPRESSURE COVERAGE REQUIRED DURING POSITIVE PRESSURE BREATHING. PHASE I,
K.N. Ackles*, W.D. Fraser*, L.S. Goodman*. Defence and Civil Institute of Environmental Medicine, North York, Ontario, Canada. M3M 3B9.
INTRODUCTION. For many years, DCIEM has studied the cardiovascular effects of positive pressure breathing (PPB) at both ground level and during exposure to high altitudes. In order to protect pilots during exposure to altitudes above 60,000 ft, a more complete understanding of the physiology of PPB is required which will lead to the design of the best possible counterpressure system. METHODS. Two currently available PPB protective systems, the Tactical Life Support System (TLSS) and COMBAT EDGE (CE) are compared in the most recent experiments as they are similar in upper body counterpressure coverage but the TLSS has a G-suit with about 45% more coverage than the standard G-suit used in CE. Following a brief review of previous DCIEM experiments in the area of PPB, the current series of Ground level and 60,000 ft experiments will be introduced. Detailed results will be presented in the subsequent papers of this panel

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EXPERIMENTAL DESIGN AND AUTOMATED ANALYSIS OF GROUND LEVEL AND RAPID DECOMPRESSION PPB STUDIES. T. Gee, W.D. Fraser*, L.S. Goodman*, K.N. Ackles*, S. Bainwohl, D. Eastman. Defence and Civil Institute of Environmental Medicine, North York, Ontario, Canada. M3M 3B9.

INTRODUCTION. Effective experimental design, automated data analysis, and statistical modelling can maximize the information collected during comparison of TLSS and CE. METHODS. 6 males and 1 female subject underwent 8 ten minute ground level exposures to PPB (TLSS & CE ensembles, 60, 70, 80, and 88 mm Hg PPB). Data was collected during the PPB exposures, 3 minute pre-control and 5 minute post control periods. 6 subjects were also exposed to 3 minutes of 60,000 ft simulated altitude and 60 mm Hg PPB following rapid decompression (RD) from 22,500 ft. wearing the two systems. Custom software coordinated all data processing, identified significant experimental events such as PPB onset, and performed error and out-of-bounds checking on all data. Multivariate analysis of covariance (MANCOVA) was used to analyze all collected data for the PPB and RD trials. RESULTS. Comparisons of the changes in cardiovascular and performance function with garment type, exposure duration and PPB levels were possible with this experimental design. CONCLUSION. The experimental and statistical designs of both the ground level and altitude experiments allow for subject by subject comparison of the cardiovascular effects of TLSS and CE systems and their effectiveness in protection against rapid decompression

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THE EFFECT OF INCREASED G-SUIT COVERAGE ON THE CARDIOVASCULAR EFFECTS OF POSITIVE PRESSURE BREATHING AT 60,000 FT. W.D. Fraser*, L.S. Goodman*, K.N. Ackles*. Defence and Civil Institute of Environmental Medicine, North York, Ontario, Canada. M3M 3B9.

INTRODUCTION. The ground level PPB study discussed previously showed that 3 minute exposures to 60 mmHg PPB with either TLSS and CE systems would not lead to cardiovascular collapse. This study compared the cardiopulmonary responses of subjects wearing the two systems to 60,000 ft. rapid decompressions. METHODS. HR, SV, CO, and oxygen saturation (SaO_2) of 6 subjects were measured during 3 minutes of exposure to 60,000 ft as described earlier. RESULTS. There were significant effects due to garment type on SV ($P < 0.004$) and CO ($P < 0.04$) with a greater decrement using CE. There was a significant effect of time at altitude on SaO_2 ($P < 0.02$) with a rapid fall SaO_2 over the three minutes but no differences between the garments. CONCLUSIONS. Both TLSS and CE provided sufficient physiological support to maintain oxygen saturations above 65%. during the three minute exposures to 60,000 ft altitude. As in the ground level studies, increased G-suit coverage resulted in improved cardiovascular function. Short term physiological support at higher altitudes with greater PPB levels or longer duration excursions at 60,000 ft may not be possible without the greater g-suit bladder coverage provided by TLSS type garments.

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CARDIOVASCULAR FUNCTION DURING POSITIVE PRESSURE BREATHING AT GROUND LEVEL. L.S. Goodman*, W.D. Fraser*, K.N. Ackles*. Defence and Civil Institute of Environmental Medicine, North York, Ontario, Canada. M3M 3B9.

INTRODUCTION. The use of positive pressure breathing (PPB) is limited in part by the cardiovascular collapse that eventually occurs with sustained PPB. The effects of prolonged exposure to high levels of PPB were compared in subjects wearing the TLSS and CE g-suit/jerkin/mask ensembles. METHODS. Heart rate (HR), stroke volume (SV), and mean arterial pressure (MAP) were collected during 8 PPB exposure periods as described earlier. RESULTS. All 7 subjects completed ten minute exposures at all 4 levels of PPB while wearing the TLSS ensemble. Mean durations for the same subjects wearing the CE ensemble were 9.3 ± 0.7, 8.3 ± 1.0, 6.0 ± 0.9, and 6.3 ± 1.3 minutes at 60, 70, 80, and 88 mm Hg PPB. There was a significant increase in HR ($P < 0.0001$) and a decreased SV ($P < 0.02$) with PPB duration, a fall in SV ($P < 0.002$) and an increase in MAP ($P < 0.01$) with increasing PPB levels. There was significant interaction between duration and garment type for HR ($P < 0.001$), SV ($P < 0.004$), and MAP ($P < 0.001$) and significant interaction between duration, garment type, and PPB level for SV ($P < 0.004$) and MAP ($P < 0.002$) and between PPB level and garment type for SV ($P < 0.0001$). There was a greater fall in stroke volume and corresponding increases in heart rate with the CE system. Subjects were unable to complete 10 minutes of the higher levels of PPB while wearing the CE ensemble. CONCLUSIONS. An increased g-suit coverage provides improved cardiovascular support during PPB at ground level.

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MINIATURIZED NUCLEAR PROBE TO MEASURE CARDIAC PERFORMANCE DURING PPB. L. S. Goodman*, J. Chan, L. Yang, M. Freeman. DCIEM, North York, Ontario M3M 3B9 and St. Michael's Hospital, Toronto Ontario, Canada.

INTRODUCTION. Detailed measurement of cardiac function during PPB is required to determine the relationship between venous return, G-suit coverage, and pressure breathing syncope. This study examined: (a) the feasibility of using a miniaturized nuclear probe (MNP) to study cardiac function during PPB; (b) the differences in cardiovascular protection against PPB afforded by TLSS vs. Combat Edge (CE) PPB ensembles. METHODS. Six experienced subjects were labled with Technesium99m, and and exposed to 70 mmHg PPB from an air source and regulator, wearing both CE and TLSS ensembles for 3 minutes. The MNP (Cardioscint™), positioned over the left ventricle, measured: ejection fraction (EF,%), left ventricular filling rate (LVfr) and relative end-diastolic volume (EDVr) every 10 s. RESULTS. EF increased by 9% from control for TLSS, but decreased by 8.5% from control with CE ($P < .05$). LVfr was decreased (-0.25) with CE, but was increased (+ 0.85 EDVcounts/s; $P < .05$) with TLSS. EDVr was reduced by -25 vs. -57 counts/10 ms for TLSS vs. CE, respectively ($P < .05$). CONCLUSION. MNP's rapidly and reliably measure cardiac function during PPB. An increase in leg bladder coverage results in greated protection against the PPB-induced reduction in cardiac filling .

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PANEL: PSYCHOLOGICAL FACTORS IN ASTRONAUT SELECTION AND TRAINING: AN INTERNATIONAL PERSPECTIVE. P.A. Santy.* UTMB, Galveston, TX 77550.

INTRODUCTION. From 1988-1991 an international working group of psychologists and psychiatrists examined the empirical literature and research findings from isolated and demanding environments for the purpose of developing optimal psychiatric select-out and psychological select-in procedures for astronaut selection. This same committee discussed psychological training methods for astronauts. Select-out procedures were implemented operationally in the U.S. Space Program in the 1989 selection. Also at that time, a study to validate select-in psychological criteria was initiated. In Japan and Europe, astronaut selection will be completed at the end of 1991. Panel members from the U.S., Japan, and Europe will present the results of the psychological selection and training procedures used in each country. The results of work on the validation of astronaut psychological selection criteria will also be presented. CONCLUSIONS. This panel will present the most recent data on the psychological selection and training of astronauts in the U.S., Japanese, and European Space Programs.

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RESULTS OF THE PSYCHIATRIC, "SELECT-OUT" EVALUATION OF U.S. ASTRONAUT APPLICANTS. D. M. Faulk,* P. A. Santy,* A. W. Holland,* and R. Marsh.* UTMB, Galveston, TX and NASA Johnson Space Center, Houston, TX.

INTRODUCTION. The psychiatric exclusion criteria for astronauts are based on NASA Medical Psychiatric Standards for Space Flight. Until recently, there were no standardized methods to evaluate disqualifying psychopathology in astronaut applicants. METHOD. One hundred and six astronaut applicants who had passed initial screening were evaluated for Axis I and Axis II DSM-III-R diagnoses using the NASA structured psychiatric interview. The interview consisted of three parts: (1)An unstructured portion for obtaining biographical and historical information; (2)The Schedule for Affective Disorders-Lifetime version (SADSL), specially modified to include all disqualifying Axis I mental disorders; and (3)The Personality Assessment Schedule (PAS), also modified to evaluate for Axis II disorders. RESULTS. Nine of 106 candidates (8.5%) met diagnostic criteria for six Axis I disorders (including V-code) or Axis II disorders. Two of these disorders were disqualifying for the applicants. "Near" diagnoses (where applicants met at least 50% of the listed criteria) were assessed to demonstrate that clinicians using the interview were able to overcome applicants' reluctance to report symptomatomatology. CONCLUSIONS. The use of the NASA structured interview was effective in identifying past and present psychopathology in a group of highly motivated astronaut applicants. This was the first time a structured psychiatric interview had been used in such a setting for this purpose.